AIRS Tuning and Performance Tests

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Microwave Tuning Results

AIRS Scan Mirror Coating Test

AIRS Tuning Plans

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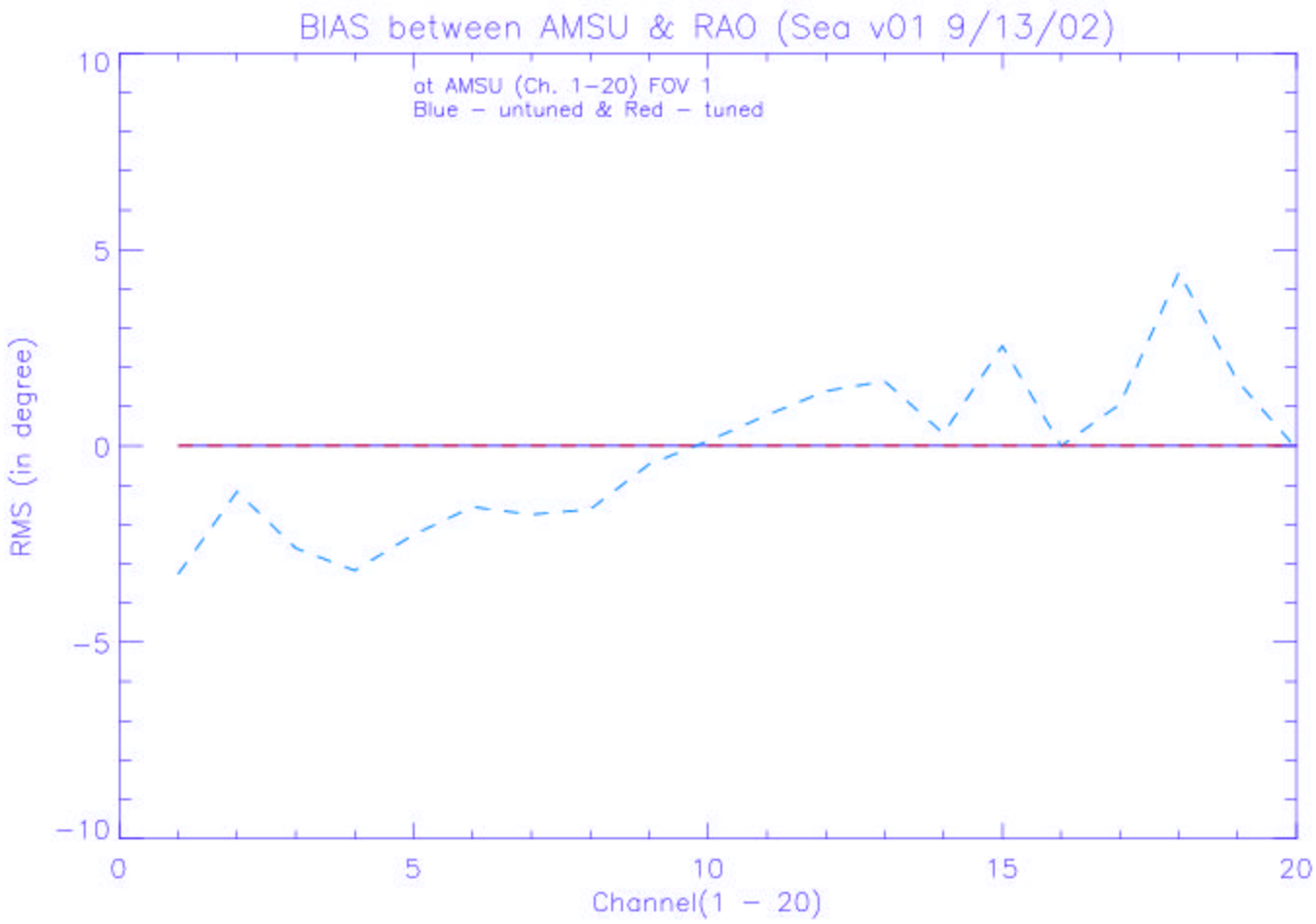
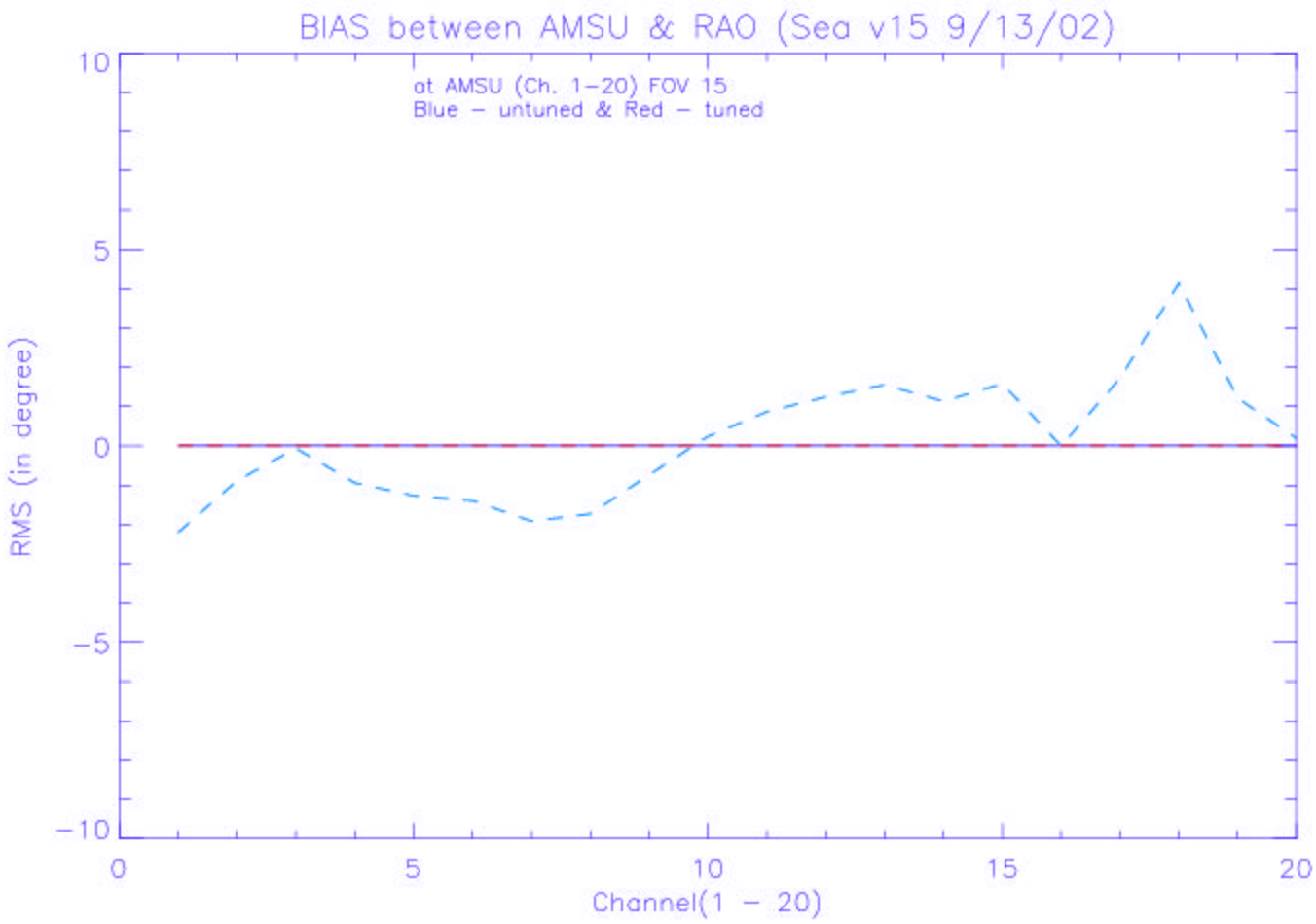
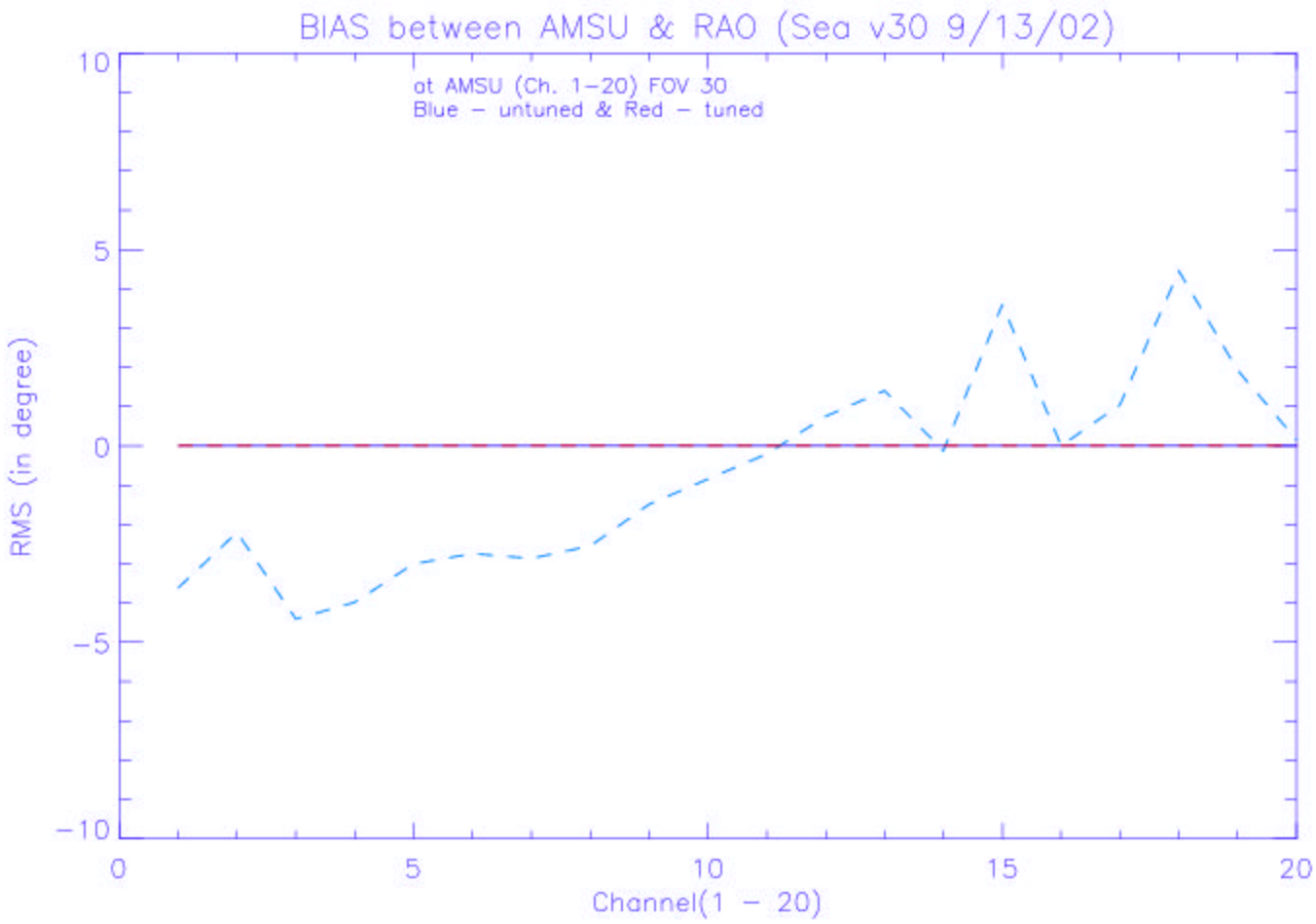
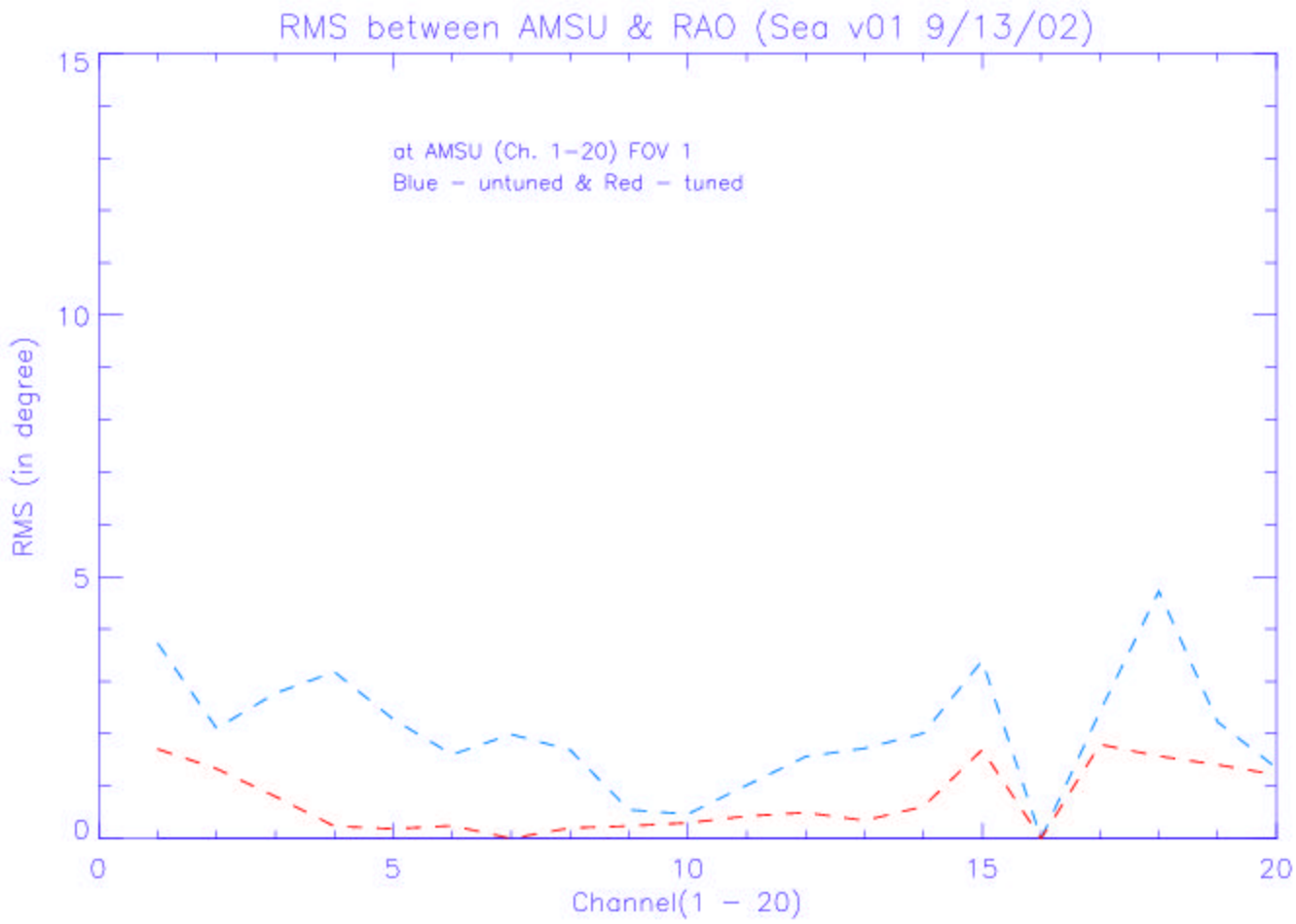
Microwave Tuning Results

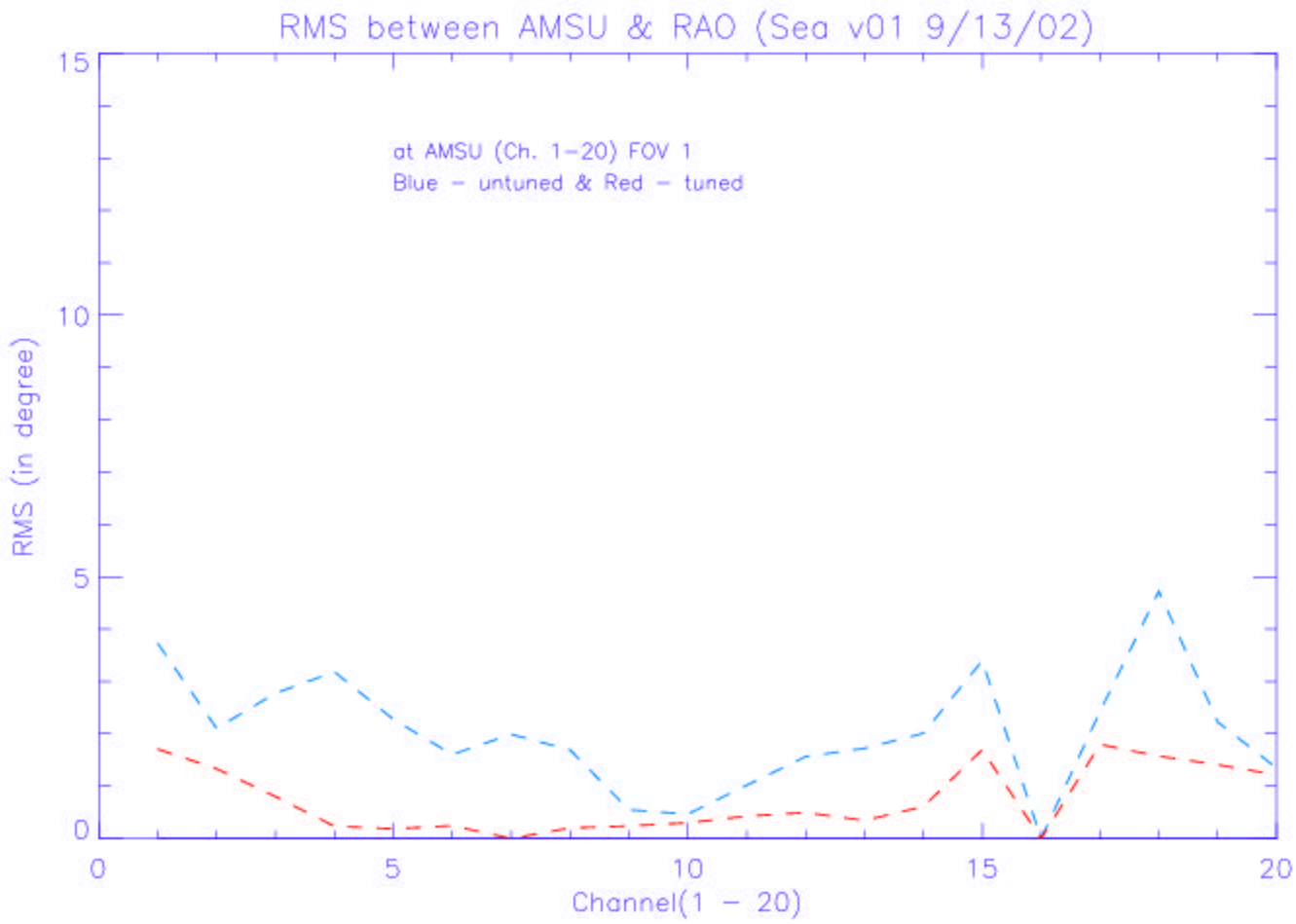
- Predict the microwave measured – calculated brightness temperature difference
  - Uses microwave channels as predictors
  - Ocean only until land emissivity is checked out
- First six slides show the Bias (first three slides) and RMS (corrected and uncorrected) as a function of channel for 3 selected views
  - 1 side,
  - 15 middle
  - 30 side

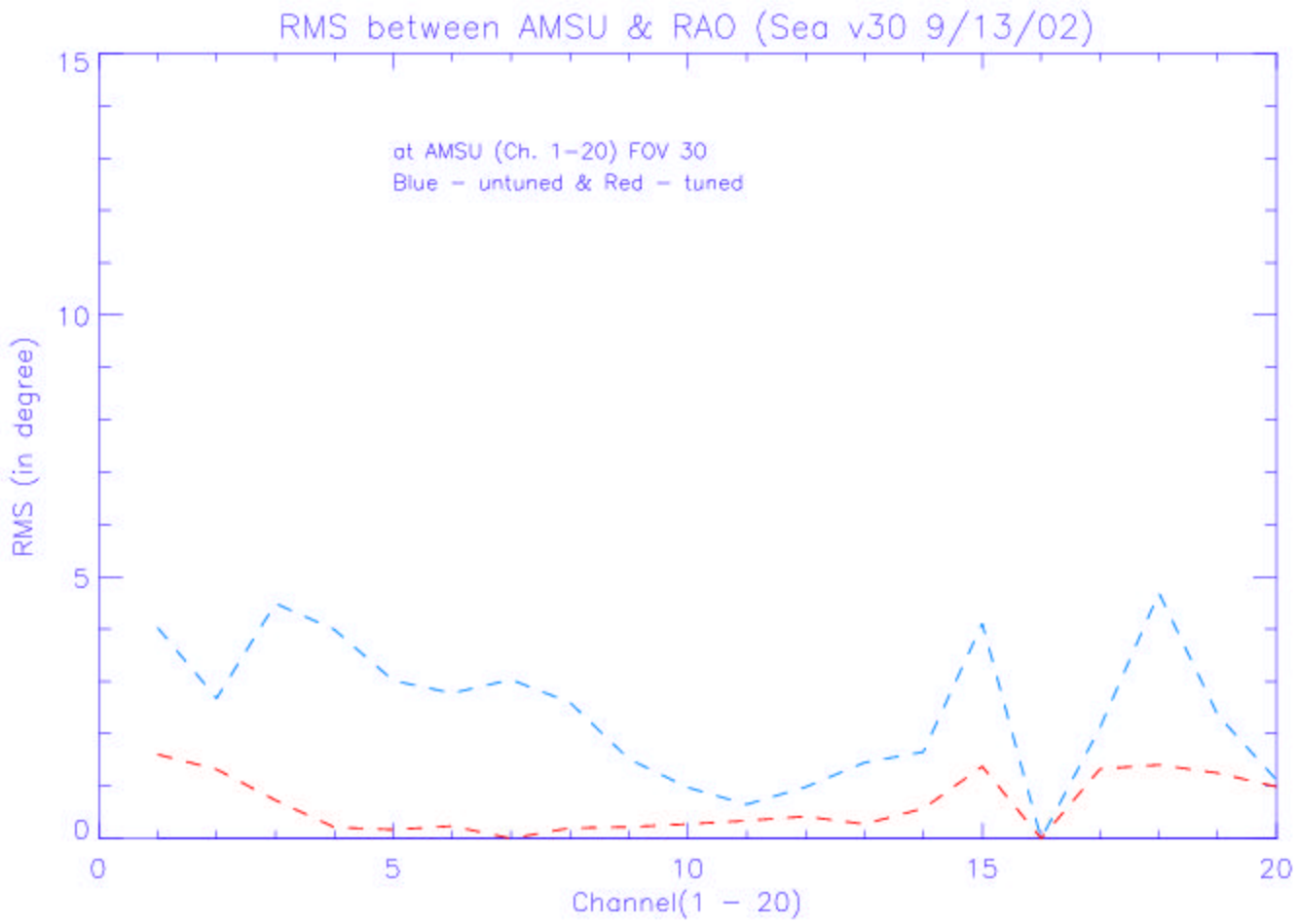

BIAS between AMSU & RAO (Sea v01 9/13/02)
at AMSU (Ch. 1-20) FOV 1
Blue - untuned & Red - tuned
RMS (in degree)
10
5
0
-5
-10
0
5
10
15
20
Channel(1 - 20)


BIAS between AMSU & RAO (Sea v15 9/13/02)
at AMSU (Ch. 1-20) FOV 15
Blue - untuned & Red - tuned
RMS (in degree)
10
5
0
-5
-10
0
5
10
15
20
Channel(1 - 20)


BIAS between AMSU & RAO (Sea v30 9/13/02)
at AMSU (Ch. 1-20) FOV 30
Blue - untuned & Red - tuned
RMS (in degree)
10
5
0
-5
-10
0
5
10
15
20
Channel(1 - 20)


RMS between AMSU & RAO (Sea v01 9/13/02)
at AMSU (Ch. 1-20) FOV 1
Blue - untuned & Red - tuned
RMS (in degree)
Channel(1 - 20)
0
5
10
15
20


RMS between AMSU & RAO (Sea v01 9/13/02)
at AMSU (Ch. 1-20) FOV 1
Blue - untuned & Red - tuned
RMS (in degree)
Channel(1 - 20)
0
5
10
15
20


RMS between AMSU & RAO (Sea v30 9/13/02)
at AMSU (Ch. 1-20) FOV 30
Blue - untuned & Red - tuned
RMS (in degree)
Channel(1 - 20)
0
5
10
15
20

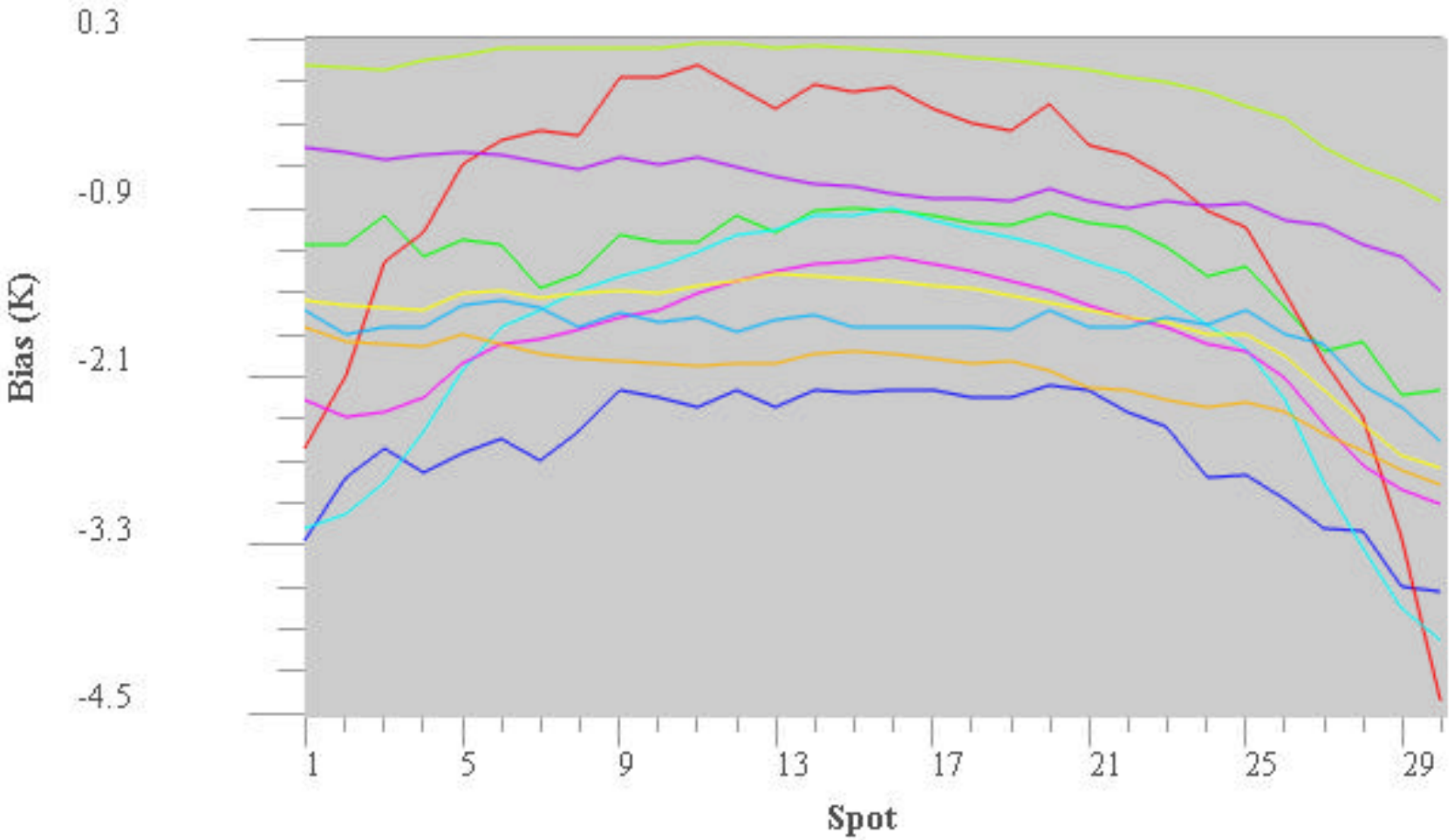
Tuning Results Continued

- The next 6 slides show
  - 1. Biases as a function of spot for channels 1 – 10
  - 2. Biases as a function of spot for channels 11 – 20
  - 3. Uncorrected RMS for channels 1 – 10
  - 4. Corrected RMS for channels 1 – 10
  - 5. Uncorrected RMS for channels 11 – 20
  - 6. Corrected RMS for channels 11 - 20

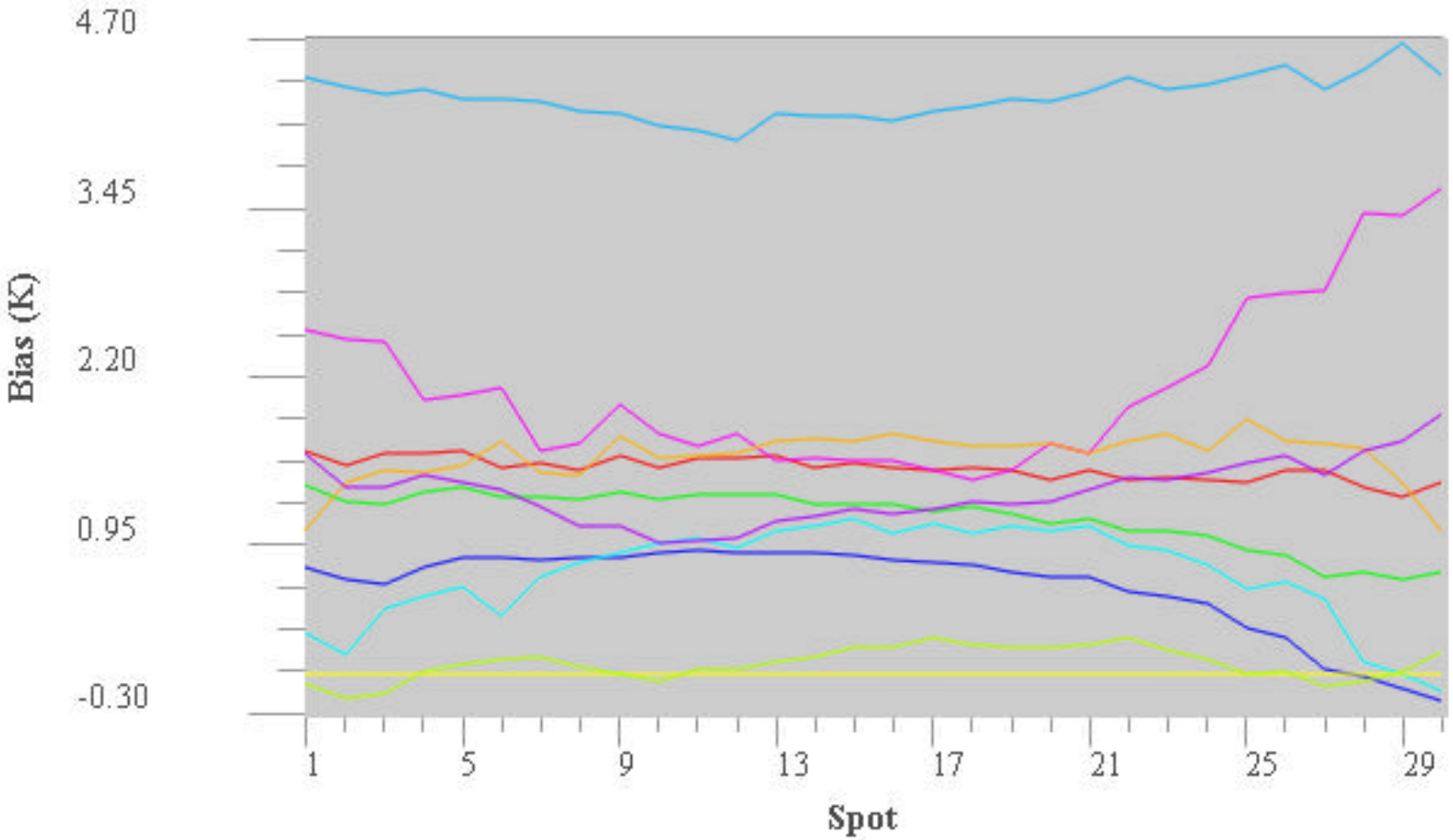
Legend for the next slides

- Channels
  - 1 - blue
  - 2 - green
  - 3 - red
  - 4 - cyan
  - 5 - magenta
  - 6 - yellow
  - 7 - gold
  - 8 - sky blue
  - 9 - violet
  - 10 - yellow - green

Spot Biases for Channels 1 - 10



Spot Biases for Channels 11 - 20



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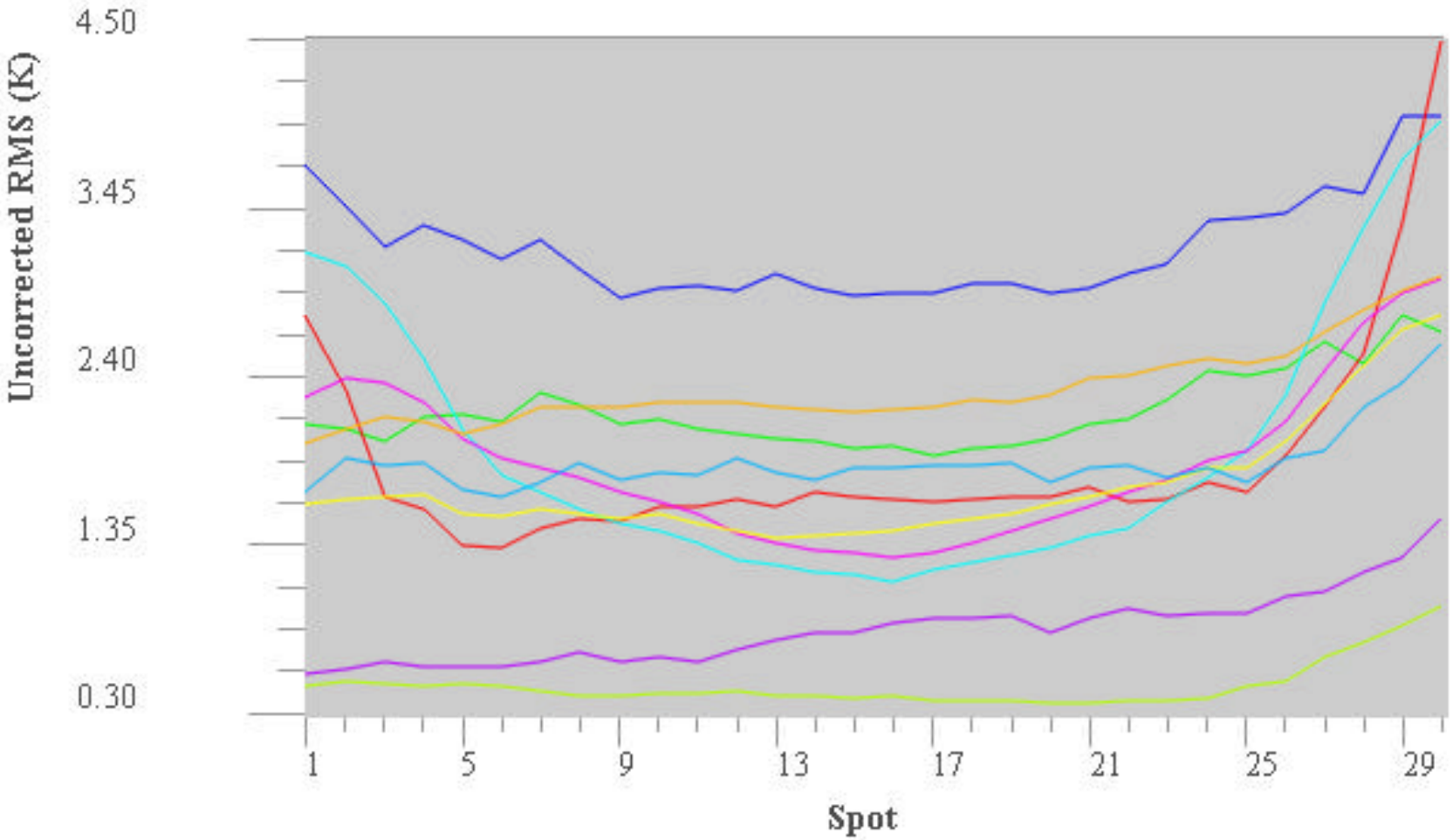
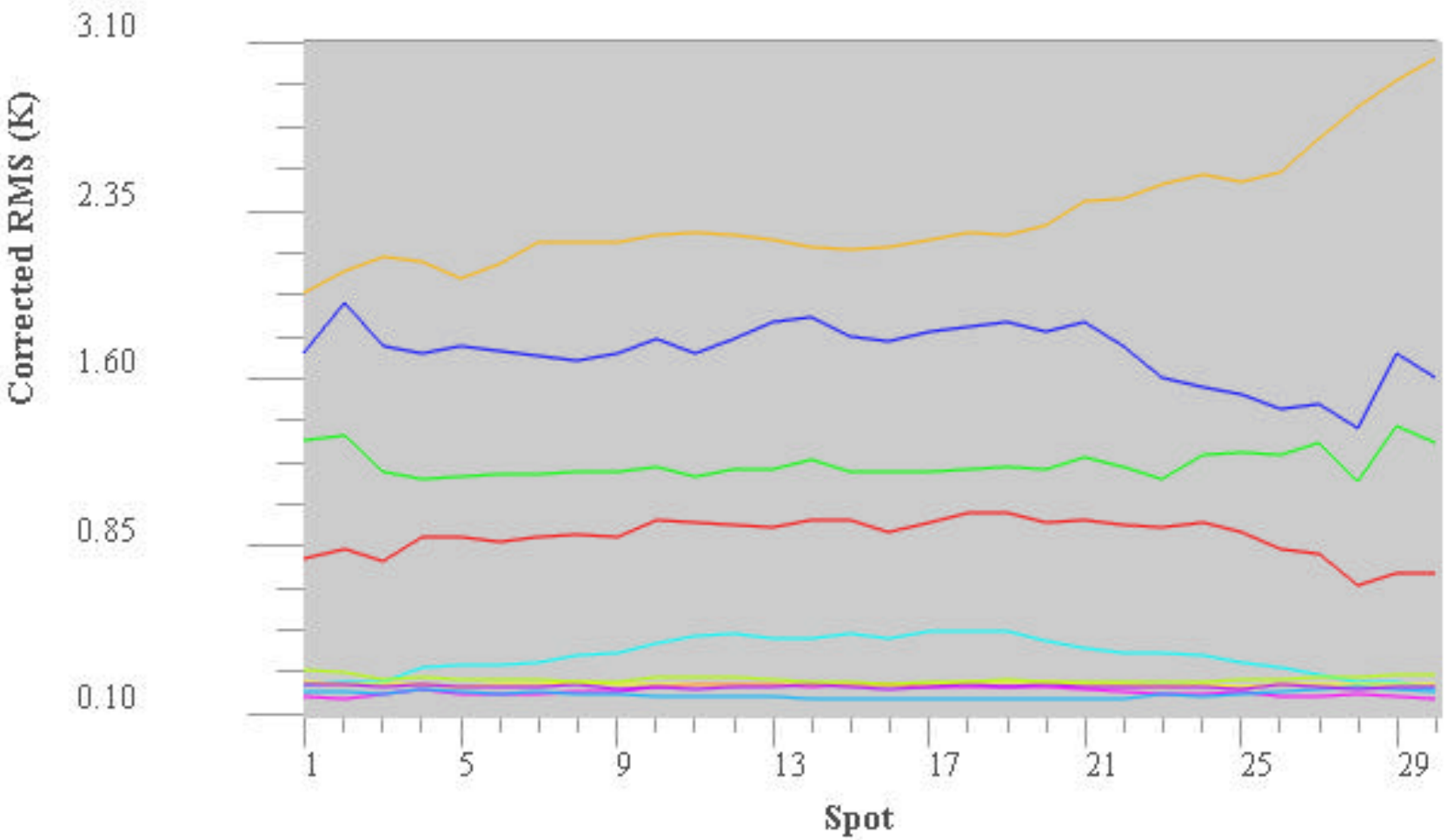
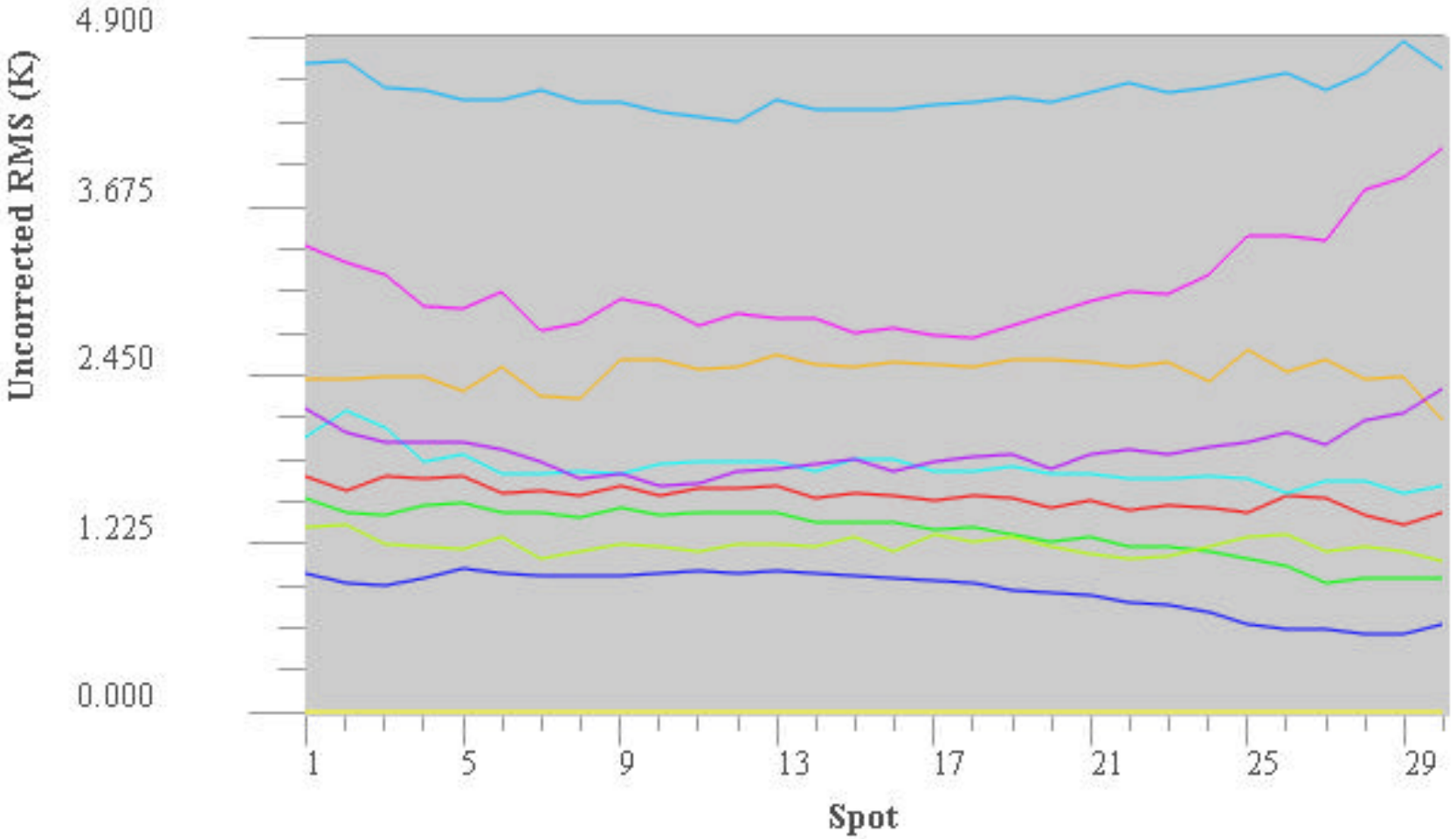
Uncorrected RMS Channels for 1 - 10



Corrected RMS for Channels 1 – 10



Uncorrected RMS for Channels 11 - 20



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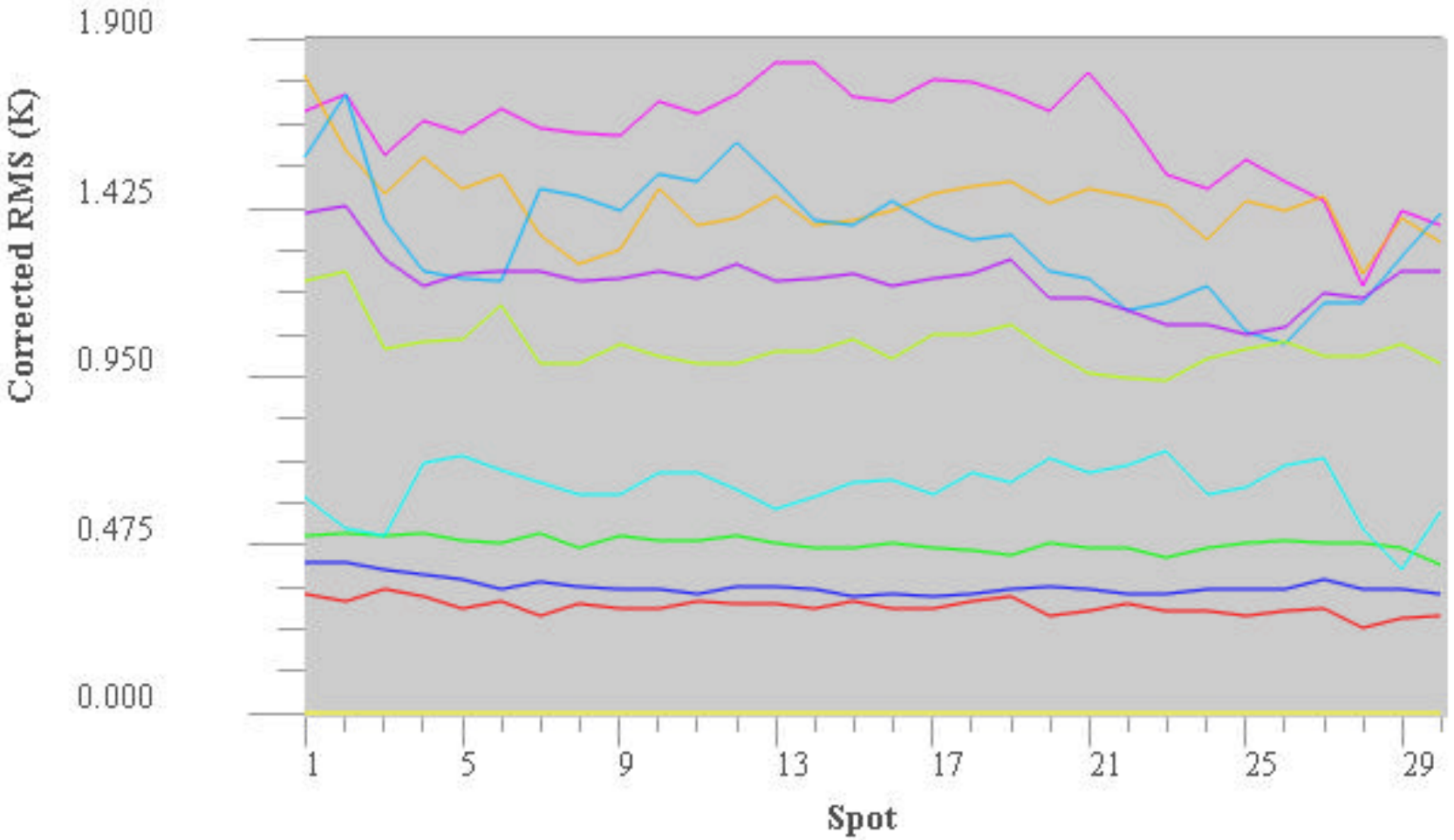
Corrected RMS for Channels 11 - 20

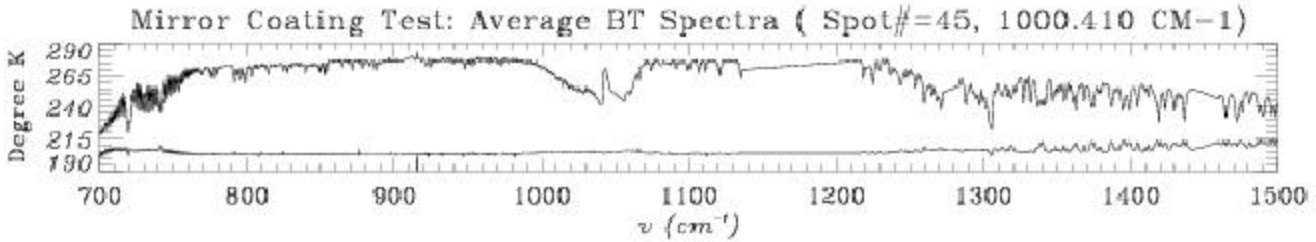


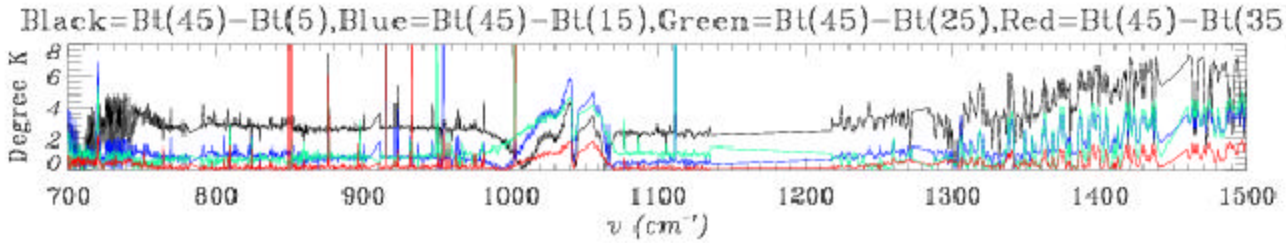
AIRS Scan Mirror Coating Test

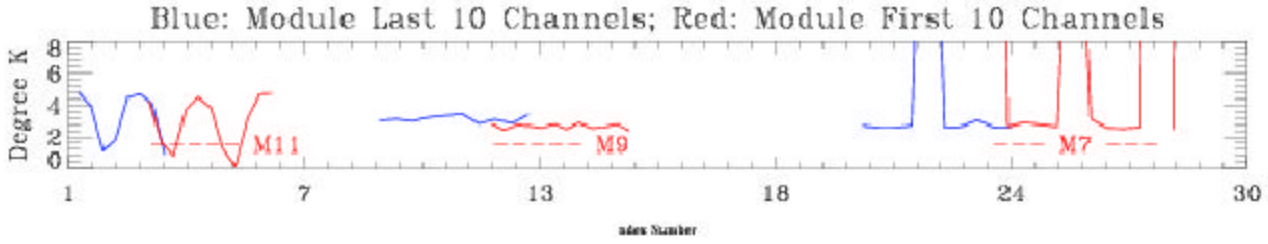
- Procedure
  - Collect a sample of cold scenes (< 210 K)
    - Assumption - no atmospheric absorption in window region
  - Calculate the average temperature as a function of scan position
  - Calculate the spot to spot difference for selected spots
    - Reference is the average of the 2 center spots (45 and 46)
    - Differences are for spots (5, 15, 25, 35) on one side
    - and (85, 75, 65, 55) on the other side

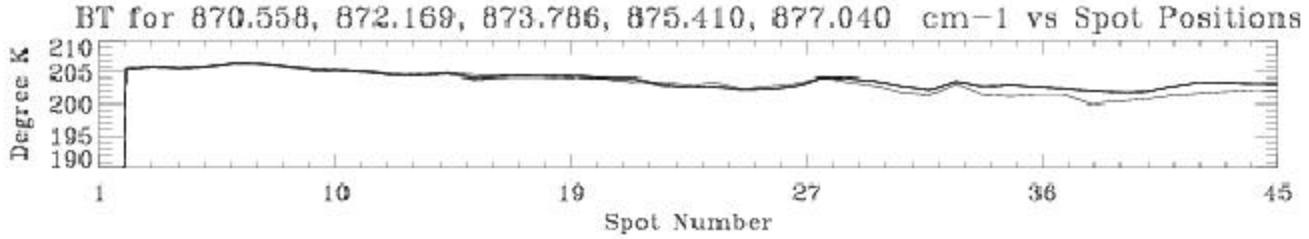
AIRS Scan Mirror Coating Test

- Figures show:
  - The spectral for a typical clear profile
  - The spot to spot differences as a function of wavelength
  - The overlap for overlapping detector arrays
  - The temperature as a function of wavelength for window channels
- Note that these channels typically see warm temperatures.
  - Therefore the effects are greatly reduced for typical earth scenes









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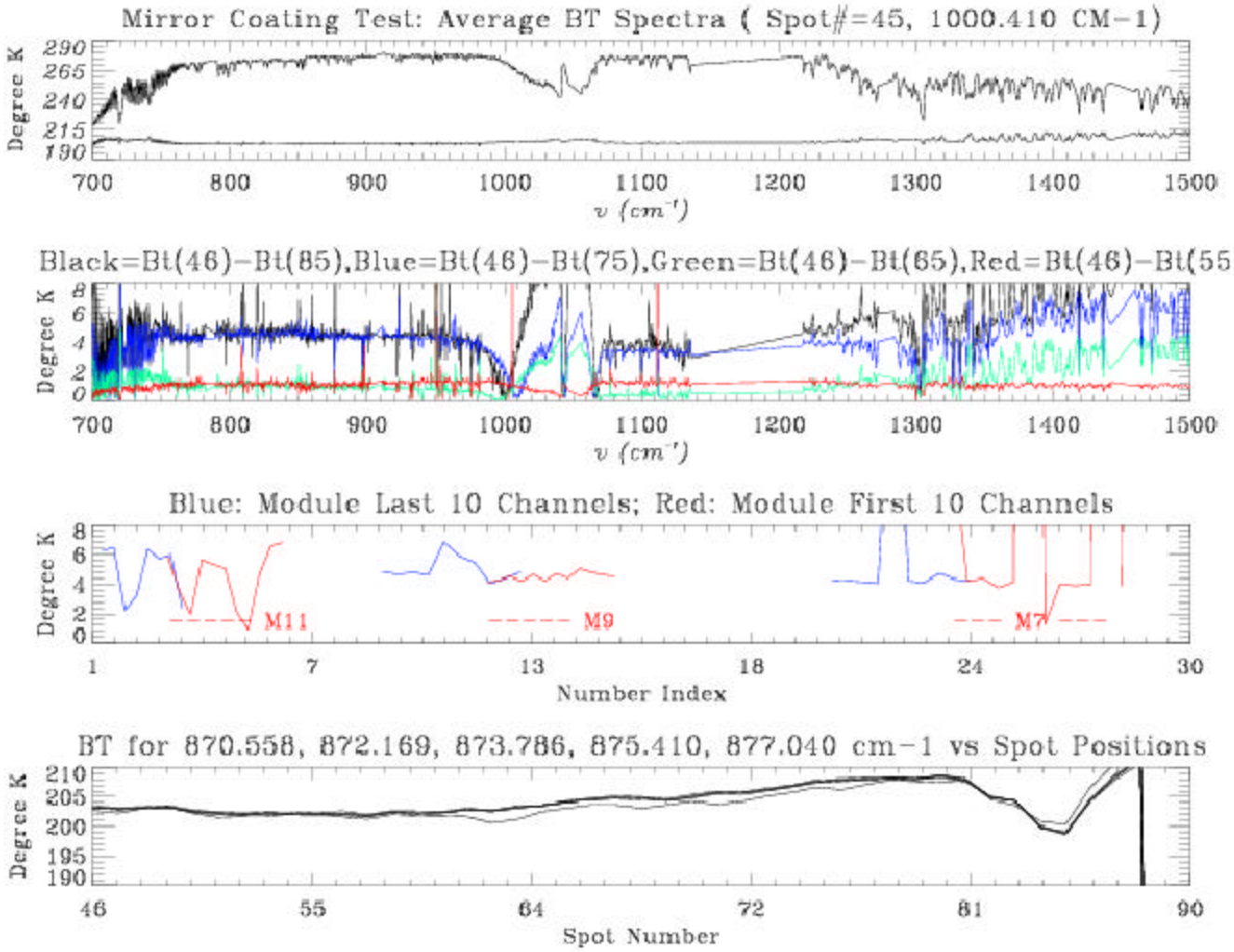

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Tuning – Obtaining the Input

- A radiance calculation requires an entire profile
  - Skin temperature, emissivity, entire profile, and gas concentrations
  - Radiosondes – most temperatures and water vapor
    - Missing – surface skin temperature, upper levels, some gases
  - Forecasts - most temperatures, water vapor, skin temperature, and some gases
    - Missing – upper atmospheric levels
- Sources for the missing information
  - Forecast
  - Retrievals
  - Regression - always available
  - Models - surface emissivity over water

AIRS Tuning Plans

- Generate tuning coefficients for the AIRS instrument as well as the microwave
- Predict the measured – calculated temperature difference
- Using
  - Eigenvectors of the channels +
  - Solar elevation angle
  - Latitude?
  - Other?

Conclusions

- Microwave has a side to side bias
- Microwave is biased without the antennae correction as expected
  - The antennae correction should reduce this
- An initial check for a scan position bias due to the mirror coating shows a pattern consistent with the measurements from the GOES witness samples with the same coating but note
  - Measurements were taken July 20th at maximum icing and need to be repeated with data after the heating
  - Effect is dependent on the temperature difference between the scene and the mirror
    - Earth scenes are warmer so the effect is small for clear measurements
    - Effect was tested using worse case conditions
- Agreement between detector modules that overlap is good